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On the Dorsal Glands as Characters of Constant Specific Value in the Coccid Genus Parlatoria, ... *Miriam A. Palmer.*

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ON THE DORSAL GLANDS AS CHARACTERS OF CONSTANT SPECIFIC VALUE IN THE COCCID GENUS PARLATORIA.

BY MIRIAM A. PALMER.

With plates XXIII to XXVIII.

THERE has been much confusion as to classification of the different species of the genus *Parlatoria*. About nineteen species have been described, but the status of so many of these has been so uncertain that authorities have differed among one another, even the same authority being found to change his opinion from time to time.

Cockerell (1896, *c*, and 1899, *b*) and Mrs. Fernald (1903) give the genus as consisting of seventeen species, but do not agree exactly in their lists of species, and Marlatt, in his manuscript of March, 1900, tentatively declares the genus to consist of at most but six species. The cause of this confusion is the want of established constant specific characters on which to base a system of classification.

It is the purpose of this paper to give the result of investigations made upon the pygidia of the females of a number of the species of this genus for the purpose of ascertaining constant specific characters. The species or so-called species studied are *aonidiformis* Green, *blanchardi* Targ., *cingala* Green, *mytilaspiformis* Green, *proteus* Curt., *pergandei* Comst., *crotonis* Ckll., *theæ* Ckll., and variety *euonymi* Ckll., *victrix* Ckll., *viridis* Full., *theæ viridis* Ckll., and *zizyphus* Lucas, these being all that have been available. All the literature at hand on these species has been carefully consulted and compared in making conclusions.

For studying the characters herein discussed great care must

be given to the technique. For this study the method used was as follows: The insects removed from under the scale were bleached in a strong solution of caustic potash, either by boiling till sufficiently bleached, or by leaving them in the solution from twelve to twenty-four hours. Great care must be exercised that the bleaching process may be carried just far enough to show all the necessary characters in the pygidium, but not so far that the insect becomes quite transparent, or there will be great danger of losing it during the process of transferring from one solution to another. The mouth-parts retain color longest, and often when the rest of the body is invisible to the naked eye the presence of the insect can be detected by the mouth-parts. After bleaching, the insects were washed twice in distilled water, being left each time for about ten minutes, then transferred to fifty per cent. alcohol for about fifteen minutes, then to ninety-five per cent. alcohol for about the same length of time. Since these insects are very difficult to transfer from one liquid to another without danger of maceration and great loss of time and energy, it was found best after removing them from the caustic potash to leave them in the same vessel, changing the liquid by means of a pipette. They were next transferred into a drop of clearing mixture* on a slide and left thus for fifteen minutes or longer, then a drop of xylol-balsam was added and the mount completed.

The materials used for this study were furnished by Professor Hunter, the head of the department, and the writer wishes to thank him for his direction and kindly assistance, to which this paper is largely due. The illustrations were all made by the writer with the use of the camera lucida.

PARLATORIA Targ.

DESCRIPTION OF GENUS.

The following description of the genus *Parlatoria* is given as gathered from the descriptions of Signoret (1868), Comstock (1881), Newstead (1901), and Green (1899), together with personal observations.

Scale of Female.—The female scale may vary from circu-

*This clearing mixture was composed of two parts, by measure, of carbolic-acid crystals and three parts of rectified oil of turpentine.

lar to elongate, and consists of two exuviæ with more or less of secretionary area around the sides.

Scale of Male.—The male scale is long, narrow, and non-carinated, with the median portion depressed after escape of male. The exuviæ are at the cephalic end. The scale is usually much smaller than that of the female.

Pygidium of Female.—The most prominent characteristics of the genus, found in the pygidium, are the conspicuous marginal gland pores, situated between the bases of the lobes and giving a granulated appearance to the pygidium, and the fringed plates or squames situated between the lobes. The circumgenital glands or spinnerets are usually in four groups, but sometimes there are a few glands present representing the missing median group as noted by Green (1899) and seen by myself in *theæ*. There are always three pairs of well-developed lobes and sometimes rudiments of the fourth and fifth pairs.

PARLATORIA ZIZYPHUS Lucas.

Plate XXIII, figures 1 and 2.

This species, being regarded as the type species of the genus *Parlatoria*, is described first. The most important generic and specific characteristics in the genus *Parlatoria* are found in the pygidium of the female, and since it is only with these characteristics that this paper pretends primarily to deal, there will hereafter be no attention paid in descriptions to any characteristics outside of the pygidium. The reason for this is the inconstancy of the characters outside of the pygidium, such as shape and color of scale and color of body. This can be plainly seen on examination and comparison of literature and will be brought out in the discussion of the synonymy of the species herein discussed.

There are four groups of spinnerets, also called circumgenital, grouped, abdominal or ventral glands. These groups are designated as the anterior lateral and posterior lateral pairs of groups. There are four pairs of lobes, the fourth lobe being fairly well developed. The first three pairs are trilobate in form; the fourth lobe is about one-third the width of the third lobe and tapers to a point. Its length is almost equal to that of the third lobe. Between the bases of the lobes are the marginal-gland orifices or semilunar pores, which resemble, on

superficial examination, chitinized crescents, but on closer examination are seen to be rather elliptical-shaped openings. Directly cephalad of each marginal-gland orifice are found structures resembling small chitinized rods. These are, according to Berlese (1896), the chitinized disks of the marginal-gland orifices. These crescents alternate with the lobes until after the third lobe, when there are two before the fourth lobe. There are also found between the lobes thin, flat, transparent, fimbricated processes called plates or squames. They are the same length as the lobes and vary in number of incisions from three to four in those plates mesad of the third lobe and number as high as eight to twelve or even more in those laterad of the third lobe. These plates are situated two in each of the spaces between the lobes mesad of the second lobes, and three in the spaces between the second and third and the third and fourth lobes.

Scattered over the pygidium and more numerous towards the edges are found the spool-shaped dorsal glands. These seem at first glance to have no definite arrangement, but on more careful observation of a number of specimens certain of these glands are found to be constant in position. These are the median dorsal gland, found on the median line just cephalad of the median marginal-gland orifice, and a pair of glands situated one on each side of the pygidium on a line drawn from the anal opening to the third lobe, and situated at about from one- to two-thirds of the entire distance from the anal orifice. This pair of glands was found in no other species studied. The arrangement of the rest of the glands is less constant. The dorsal glands near the margin and laterad of the median gland are sometimes arranged in a row even with the median dorsal gland, there being one dorsal gland approximately above each marginal gland. (See Pl. XXIII, fig. 1.) In different specimens and even in the two sides of the same specimen the arrangement of the glands laterad of the median gland may vary considerably, some being found more cephalad and some more caudad than the median dorsal gland. The number has been found to be fairly constant. There is also sometimes a second pair of glands found half-way between the pair above mentioned and the second or third lobes.

This species has been found on *Zizyphus pinnachristi*, date-

palm, and the following varieties of citrus: Orange, lemon, and mandarin. The habitat is Europe, Algeria, Hawaiian islands, Formosa, China, West Australia, and in the United States on imported fruit.

This description has been made from the study of ten mounted specimens from lemon, mandarin, and a citrus plant whose variety is not given, with descriptions by Signoret (1868), Berlese (1896), Newstead (1901) and Comstock (1883) at hand and used for reference.

PARLATORIA BLANCHARDI Targ.

Plate XXIV, figure 2.

This species has four groups of circumgenital glands. There are three pairs of well-developed lobes. The rudimentary fourth lobe is absent. The form of the lobes is not trilobate, as in *zizyphus*, but broadly rounded at the ends, without notches on either side. The marginal-gland orifices are of the same form as in *zizyphus*, but the chitinized disks are not visible. The plates have the same arrangements as those in *zizyphus*, but are narrower in shape. Those along the sides laterad of the third lobe are much longer and have fewer incisions than those in *zizyphus*. The median dorsal gland is present. Laterad of this median dorsal gland and cephalad of the second marginal-gland orifice is a group of three dorsal glands. Cephalad of the third marginal-gland orifice and the third lobe is another group of three or four dorsal glands. The chitinized disks are not distinctly visible, or are seen very close to the orifices, the glands being probably situated almost at right angles to the body wall, so that the chitinized disks are hidden below the orifices.

Food-plant is the date-palm. Habitat: Australia, Algeria, and the Sahara. Described from nine mounted specimens.

PARLATORIA VICTRIX Ckll.

Plate XXIV, figure 3.

Victrix agrees in every particular with *blanchardi*. The food-plant is also the same. They differ only in habitat as given, *victrix* being found in Arizona, and *blanchardi* in Algeria, Sahara, and Australia; but Marlatt, in his manuscript of 1900, says that Cockerell's *victrix* originally came from the same locality as *blanchardi*. *Victrix* has been determined as synony-

mous with *blanchardi* by Hunter in manuscript, and Marlatt in manuscript, and it is so given by Mrs. Fernald (1903).

Studied from thirty mounted specimens taken from material received from Cockerell.

PARLATORIA CINGALA Green.

Plate XXVIII, figure 2.

This species differs from *zizyphus* in the number and shape of the lobes. There are three pairs of well-developed lobes. There is no rudimentary fourth lobe, but in place of it is found a broadly spindle-shaped thickening, situated with its long axis coincident with the body line. The lobes are not notched or trilobate as in *zizyphus*, but entire in outline and of a shape peculiar to the species, as shown in the figure. The marginal-gland orifices appear in crescent form between the lobes till laterad of the third lobe, when they appear more of the oval type. The chitinized disks are distinctly visible with both forms of glands. The plates are found situated as in *zizyphus*, but they tend to have fewer incisions, varying from two or three to four mesad of the third lobe. There are no dorsal glands found in the region of the pygidium cephalad of the first and second pairs of lobes. There is a large gland found directly cephalad of the third lobe. The pore of this gland lies with its long diameter parallel to the median line instead of at right angles to it as the pores in *zizyphus*. Along the edge of the body laterad and cephalad of the third lobe the dorsal glands are numerous.

The food-plants are leaves of the *Flacourtia* and *Scologia*. The habitat is Ceylon.

Described from five mounted specimens taken from material received from E. E. Green, together with his (1899) original description and figure.

PARLATORIA AONIDIFORMIS Green.

Plate XXIV, figure 1.

This species has four groups of circumgenital glands as in *zizyphus*, though they are not shown in the figure because they were not observed, the only specimens available not being sufficiently well cleared to show them satisfactorily. There are three pairs of well-developed lobes, decreasing in size from the

median line outwards. The rudimentary fourth lobe is more or less developed. The first three pairs of lobes have each two notches on the outer edge and one or two on the inner edge. The marginal gland pores are found as in *zizyphus*, except that there is only one between the third and fourth lobes, while in *zizyphus* there are two. The chitinized disks of the marginal glands are present though not very prominent. The plates are unusually narrow and long; the incisions are not deep, and average about three or four in number. There are no dorsal glands like those in *zizyphus* to be found in the pygidium, but there are, according to Green (1899), and indistinctly seen in specimens observed, minute circular glands arranged in a row cephalad of the second lobe.

Food-plants: *Northopegia colebrookiana*. Habitat: Ceylon.

Described from two mounted specimens from material received from Green, supplemented by reference to Green's (1899) original description and drawing.

PARLATORIA PROTEUS Curt.

Plate XXV, figure 2.

pergandei Comst. Plate XXV, figure 1.
crotonis Dougl. Plate XXVIII, figure 1.
mytilaspiformis Green. Plate XXVI, figures 1 and 2.
theæ Ckll. Plate XXVII, figure 1.
var. ? **euonymi** Ckll. Plate XXVII, figure 2.
var. ? **viridis** Ckll. Plate XXVII, figure 3.

Proteus has four groups of circumgenital glands. There are three pairs of well-developed lobes. The rudimentary fourth lobe is absent and in its place is found a plate. The lobes are trilobate in form. The marginal gland orifices are as in *zizyphus*. The position of the dorsal glands, however, differs from that in *zizyphus*, there being no median dorsal gland. Neither is the pair of glands mentioned as characteristic in the description of *zizyphus* found in *proteus*. The glands are also fewer in number. There is a pair of glands cephalad of the first pair of lobes, a single gland cephalad of the third marginal gland or the third lobe; then come numerous glands whose arrangement seems to be less constant.

Food-plants: *Selenipedium*, *Macrozamia*, *Pinus insignis*, *Myrtus*, *Citrus*, *Camellia*, *Machillus*, apple, date-palm, and *Vanda*.

Habitat: Europe, Australia, Japan, China, Formosa, Hawaiian islands, Brazil, and Ceylon.

Described from ten mounted specimens from *Pinus* and orchid from Ceylon and Japan, with Comstock's (1883), Newstead's (1901) and Signoret's (1869) descriptions at hand for reference.

pergandei Comst. Plate XXV, figure 2.

Pergandei has four groups of circumgenital glands. There are three pairs of well-developed lobes, trilobate in form. The rudimentary fourth lobe is present but not nearly so well developed as in *zizyphus*. It is often only a pointed prominence of the body wall, bearing a spine. The rudimentary fifth lobe is also present and similar in form and degree of development to the fourth lobe. The marginal-gland orifices are situated as in *zizyphus* and the chitinized disks are present. The plates are similar in form and position to those in *zizyphus*. The dorsal glands are the same in nature and arrangement as those in *proteus*.

Food-plants: Orange, lemon, and japonica. Habitat: Mexico, Japan, Hawaiian islands, Algeria, Europe, and southern United States.

Described from eleven mounted specimens from material on orange from China, Florida, and Lawrence greenhouse, with the original description of Comstock (1881), and also Newstead's (1901) description at hand.

mytilaspiformis Green. Plate XXVI, figures 1 and 2.

Mytilaspiformis has four groups of spinnerets or circumgenital glands. There are three pairs of well-developed lobes, trilobate in form. The rudimentary fourth and fifth lobes are very variable, being found present in some specimens and absent in others, even being present sometimes on one side and absent on the other in the same individual. The marginal glands and plates are found the same in form and position as in *zizyphus* and in *proteus*. The form and arrangement of the dorsal glands are the same as in *proteus*.

Food-plants: *Psychotria thwaitesii* and tea plant. Habitat: Ceylon.

Described from four mounted specimens from material received from Green, together with his (1899) original description and figure.

theæ Ckll. Plate XXVII, figure 1.

Theæ has the four groups of circumgenital glands found in *zizyphus*, but in addition there are one or two glands representing the missing median group. Cockerell (1896, *b*), in his description, says that there is but one median gland, but in one specimen observed two glands were seen, as shown by the figure. There are three pairs of well-developed lobes, decreasing in size from the median line outwards, and trilobate in form. The rudimentary fourth lobe is tolerably well developed and resembles that of *pergandei*. The marginal glands and plates are the same in form and position as in *proteus*, *pergandei*, and *zizyphus*. The dorsal glands are the same in character and arrangement as in *pergandei* and *proteus*.

Food-plant: Tea plant and Japanese maple. Habitat: Japan.

Described from four mounted specimens, together with Cockerell's (1896, *a* and, 1896, *b*) descriptions at hand.

theæ var. **euonymi** Ckll. Plate XXVII, figure 2.

This group differs from *theæ* only in having no representative of the median group of circumgenital glands, as ascertained from the study of four type specimens and reference to Cockerell's (1897) original description.

Food-plant: *Euonymous*. Habitat: Japan.

viridis Full., syn. **theæ viridis** Ckll. Plate XXVII, figure 3.

Viridis has five groups of circumgenital glands according to Cockerell (1896, *a*), the median group being represented by from one to four glands. In the specimens studied, however, it was impossible to determine whether the median group was present or not, the specimens not being sufficiently well cleared, and they are accordingly not shown in the figure. There are three pairs of well-developed lobes, decreasing in size from the median line outward. They are trilobate in form, and the tips are usually more produced beyond the plates than in *theæ*. The rudimentary fourth lobe is about the same in form and development as in *pergandei*. The marginal glands are the same in form and position as in *theæ* and *pergandei*. The plates are the same in position as those in *theæ*, but are generally not quite so long, allowing the lobes to project slightly beyond them, but this characteristic is rather variable. The dorsal glands have

the same form and arrangement as those in *theæ*, *pergandei*, and *proteus*.

Food-plant: *Theæ viridis* has been found on *Ilex pedunculosa* in Japan, and *viridis* on *Pittosporum* in West Australia.

Described from three specimens of *viridis* and eight specimens of *theæ viridis*, four of which are type specimens, together with Cockerell's (1896, *a*, and 1896, *b*) original descriptions and drawings.

proteus var. crotonis Dougl. Plate XXVIII, figure 1.

Crotonis has four groups of circumgenital glands. There are three pairs of well-developed lobes, trilobate in form, and decreasing in size from the median line outwards. The presence of the rudimentary fourth lobe is very variable. The marginal glands, plates and dorsal glands are as in *proteus* and *pergandei*.

Food-plant: Croton. Habitat: Antigua, Jamaica, Great Britain, and in Massachusetts in botanical gardens.

Described from five mounted specimens, with descriptions by Newstead (1901), Cockerell (1892, and 1899, *a*).

DISCUSSION OF SYNONYMY.

The above so-called species described under *proteus* have been determined synonymous on the basis of the similarity of the arrangement of the dorsal glands. Although described as separate species, their validity has never been finally established. The distinguishing characteristics given by the various authorities have in every case proved inconstant or not of specific value, as will be brought out in the following discussion of the synonymy of these species with *proteus*.

Comstock (1883) differentiates *proteus* and *pergandei* on the basis of the shape of the scale of the female, given as circular in *pergandei* and elongated in *proteus*, but in 1881, in his original description of *pergandei*, he says that the scale of the female varies, being sometimes nearly circular but usually somewhat elongated. Hunter (1900 or 1904) says he finds no steadfast distinction either in shape or color of the female scale, finding circular scales among *proteus* and elongated scales among *pergandei*. Newstead (1901) says that the puparium of the female of *pergandei* is very variable, often being circular but sometimes elongate. It is accordingly evident that there has been no specific distinction found in the scale.

Comstock (1881), in a foot-note, mentions as a distinction between *proteus* and *pergandei* Signoret's description of the plates in *proteus* as being smooth on the mesal margin and serrate on the lateral, while those in *pergandei* are palmately incised, but this distinction has neither been observed by the writer nor found in any other descriptions or figures, and Comstock (1883) himself, in his later description and figure of *proteus*, shows the plates of *proteus* just the same as those of *pergandei*.

Newstead (1901) gives as a distinctive characteristic between these two groups the distinction of the rudimentary fourth lobe, present in *pergandei* and absent in *proteus*. This characteristic has been determined by the writer, on examination of a number of the so-called allied species, to be not of specific value, as will be brought out in the following discussion of the rest of the species above pronounced synonymous with *proteus*.

Authorities are also undecided on the question of the status of *pergandei*. Cockerell (1896, *c*) gives *pergandei* as a distinct species, and (in 1899, *b*) as a variety of *proteus;* and Marlatt, in his manuscript of 1900, says *pergandei*, which he makes a separate species, merges into *proteus*.

We will now investigate the status of *mytilaspiformis* as a valid species. Green (1899), in his original description, says that the species approaches very closely to *proteus*, but that it may be distinguished by the elongate form of the female scale and by the more prominent and elongate lobes of the pygidium. He also says that the pellicle or exuviæ of the male scale of *proteus* is said to be black. As to the shape of the scale, *proteus* is also often elongated, as discussed above, and examination of specimens of *mytilaspiformis*, on *Psychotria*, sent by Green, and *proteus* on orchid collected by Green, *proteus* on orange from China, sent by Craw, and *proteus* on *Pinus* from West Australia shows that there is much variety in the shape of the scale; in *mytilaspiformis* some being quite elongate while others are nearly circular, and in *proteus* they also vary from some as long as those in *mytilaspiformis* to nearly circular; so that no distinction in shape of scale can be observed. As to the more prominent and elongate lobes of the pygidium, no difference of any moment was detected by the writer either by observation of specimens

or by comparison of descriptions or figures in any literature at hand. This cannot therefore be of specific value.

As to the color of the pellicle of the male scale, Signoret (1869) says that in *proteus* the male scale is light brown with the exuviæ blackish. Newstead (1901) says the exuviæ are pale yellow with dark green dorsum. Comstock (1883) says the exuviæ of the male are black. In *mytilaspiformis*, Green says that the pellicle is yellow with greenish center. According to these descriptions, the exuviæ of the male in *proteus* seem to vary from pale yellow with dark green dorsum to black, and there does not seem to be any sufficiently constant difference between the two groups to differentiate *mytilaspiformis* a valid species. Now there remains only the rudimentary-fourth-lobe characteristic which might be looked to for differentiation, but it is found to be inconstant, being present together with the rudimentary fifth lobe in some individuals and absent in others, and even being present on one side and absent on the other of the same individual. In some the place of the rudimentary fourth lobe is filled by a plate, as in *proteus*. No valid specific difference between *mytilaspiformis* and *proteus* seems to have been found, thus confirming the synonymy determined on the basis of the arrangement and character of the dorsal glands.

Theæ euonymi agrees in all observed characteristics with *theæ* except in the presence of the median ventral glands as mentioned above. Since it has never been named as anything but a variety of *theæ*, no discussion of it here is necessary.

Cockerell (1896, *b*, and 1896, *a*) describes *viridis*, making it a variety of *theæ*. Fuller (1897 and 1899) describes a distinct species which he names *viridis*. Neither of Fuller's descriptions is at hand, but specimens received from him were compared with type specimens of *theæ viridis* Ckll. and no differences were detected in any pygidial characters. Cockerell (1896, *b*), though he names *viridis* as a variety of *theæ*, says that he is not certain that it is not a valid species. A discussion of the value of the characters which he gives as distinguishing it from *theæ*, namely, the length of the median plates, which he says are shorter than the lobes, the bright green color of the body of the female, the five groups of ventral glands, the pale, flattened scale, would not be to the point here except so far as they might affect the relation of *viridis* to *proteus*. As to the

length of the median plates, no difference can be observed between this group and *proteus*, this character being found variable in both. Nor does the color of the body seem to be a sufficiently constant character to distinguish it as a species. The body color in *proteus* is said by Newstead (1901) to be variable but usually purplish. Comstock (1881) says that in *pergandei* it varies from nearly white to purplish. Whatever difference there may be in the color of the body of the female in these two groups would not seem, therefore, to be of specific moment, though it might distinguish a variety. As to the five groups of ventral glands, there has not been opportunity in this study to investigate their constancy as a specific characteristic, but they do not seem to be considered to be of specific moment by Cockerell himself, for in 1897 he places *euonymi*, which has no median glands, as a variety of *theæ*, which has the median group represented. This cannot therefore distinguish it as a different species from *proteus*. Neither does the pale, flattened scale separate it from *proteus*, for in *proteus* pale, flattened scales were also found upon observation of specimens at hand. From study of pygidial characters no noticeable differences from *proteus* were found except the fourth lobe, which was the same as that in *pergandei*; but *pergandei* has already been determined to be synonymous with *proteus*.

The status of *crotonis* also is unsettled, and this affords another argument for the synonymy of *proteus* and *pergandei*, and the invalidity of the fourth-lobe characteristic, which is found to be quite variable in this group. *Crotonis* has been described by Douglas (1887) as a variety of *proteus*. Later Cockerell describes *crotonis* as a variety of *pergandei*, but (in 1899, *a*) he says that it appears to be the same as that described by Douglas, whose article on the subject he had overlooked. However, in 1902 he makes it a distinct species, on what basis is not known to the writer, the article not being available, but his previous changes of opinion would seem to indicate that he found no strong distinctive characteristics. The same unsettled state of opinion is seen in the case of Newstead. In 1900 he gives *crotonis* as a variety of *pergandei*, and in 1901 as a variety of *proteus*. From this it appears that *crotonis* has no distinctive character to differentiate it as a species, and that

there is no constant character differentiating *proteus* and *pergandei*.

SUMMARY.

1. There have been no constant specific characteristics established in the coccid genus *Parlatoria* on which to base a system of classification. This is shown by the resulting confusion and difference of opinion as to the status of many described species.

2. The shape and color of the scale and color of the body of the female are so easily affected by change of environment, and on observation of specimens are found to vary so much in the same species, that it seems useless to look to these characters to find constant specific characteristics on which to base a system of classification.

3. The pygidium of the female being less exposed to external influences and being much used, it would seem that its characteristic structures would be most likely to persist. It has, therefore, been to this part of the body that the investigations of this study have been directed.

4. In the pygidium the dorsal glands have been found to possess a certain constancy in character and arrangement, differing in the different species, but remaining quite constant in the different individuals of the same species.

5. A comparison of the results obtained by my investigations with the opinions of the different authorities as extracted from the available literature shows that in every case where the distinction of the form and arrangement of the dorsal glands was found the status of the group as a valid species was unquestioned. On the other hand, where there was no distinction in these glands the authorities were found to differ among themselves, and the characters given as distinguishing the species have on investigation proved invalid. The classification made on this basis was found on comparison to agree exactly with Marlatt's synonymy, tentatively worked out and given in his manuscript of 1900, except that *pergandei*, which Marlatt makes a separate species, but says merges into *proteus*, is here made synonymous with *proteus*. On what basis Marlatt determined his synonymy is unknown to the writer of this paper.

6. Based upon the above-discussed characteristic of the form

and arrangement of the dorsal glands, the following classification or key to the species has been worked out:

A.—Dorsal glands absent or very minute and inconspicuous in the portion of the pygidium cephalad of the first and second pairs of lobes.

B.—Large dorsal gland with longitudinal pore cephalad of the third lobe, the rudimentary fourth lobe replaced by a spindle-shaped thickening (see pl. XXVIII, fig. 2); lobes not notched or serrate.. .....*cingala.*

BB.—No pronounced dorsal gland cephalad of the third lobe, the rudimentary fourth lobe present; lobes notched .....*aonidiformis.*

AA.—Dorsal glands present and easily seen in well cleared specimens in the portion of the pygidium cephalad of the first and second pairs of lobes.

B.—Median dorsal gland present. (Pl. XXIII, fig. 1.)

C.—Chitinous disks of marginal glands visible.....*zizyphus.*

CC.—Chitinous disks of marginal glands not visible.....*blanchardi.*

BB.—Median dorsal gland absent..... .....*proteus.*

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